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OBJECTIVES OF SCIENCE EDUCATION, COMPILED AS A GUIDE TO THE DEVELOPMENT OF AN ASSESSMENT PROGRAM IN SCIENCE EDUCATION.

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DESCRIPTORS- *EDUCATIONAL OBJECTIVES, *SECONDARY SCHOOL SCIENCE, *SCIENCE EDUCATION, *SCIENTIFIC ATTITUDES, BIBLIOGRAPHIES, COLLEGE SCIENCE, CURRICULUM EVALUATION, ELEMENTARY SCHOOL SCIENCE, EVALUATION, SCIENTIFIC LITERACY, TAXONOMY OF EDUCATIONAL OBJECTIVES, CARNEGIE FOUNDATION,

THE OBJECTIVES OF SCIENCE EDUCATION CONSIDERED IMPORTANT BY SELECTED PERSONS IN THE UNITED STATES WERE ASCERTAINED. THESE OBJECTIVES WERE USED BY THE EXPLORATORY COMMITTEE ON ASSESSING THE PROGRESS OF EDUCATION TO DEVELOP A PROGRAM TO ASSESS THE EDUCATIONAL ATTAINMENTS OF REPRESENTATIVE NINE, 13, AND 17 YEAR-OLDS AS WELL AS ADULT HIGH SCHOOL GRADUATES. THE OBJECTIVES WERE DERIVED FROM (1) A STUDY OF THE LITERATURE, (2) STATEMENTS OF MEMBERS OF THE COMMITTEE OF CONSULTANTS, AND (3) COMMENTS BY REVIEWERS OF THE PRELIMINARY DRAFT OF OBJECTIVES. THE MAJOR OBJECTIVES, STATED IN TERMS OF STUDENT BEHAVIOR WERE--(1) THEIR ABILITY TO APPLY, IN APPROPRIATE SITUATIONS, THE METHODS, TECHNIQUES, AND RATIONAL PROCESSES ASSOCIATED WITH SCIENTIFIC WORK, (2) THEIR UNDERSTANDING OF THE MAJOR CONCEPTUAL SCHEMES THAT CURRENTLY INTERRELATE, AND FORM THE CORE OF, THE VARIOUS SCIENTIFIC DISCIPLINES, (3) THEIR UNDERSTANDING OF THE POSITION, LIMITATIONS, AND POTENTIAL OF SCIENCE AND ITS APPLICATIONS IN TODAY'S SOCIETY, AND THEIR ATTITUDES TOWARD SCIENTISTS AND THEIR WORK, (4) THEIR INTERESTS IN SCIENCE, WHICH FOR SOME STUDENTS ARE MANIFESTED BY MOVEMENT TOWARD SCIENTIFIC OR TECHNICAL CAREERS, AND WHICH FOR ALL STUDENTS ARE DISPLAYED OUTSIDE FORMAL SCHOOLING BY THEIR CONTINUED LEARNING IN, AND ATTENTION TO, SCIENTIFIC SUBJECTS, AND (5) THEIR REALIZATION OF SCIENCE AS A HUMAN INTELLECTUAL ACTIVITY. THE STATEMENTS OF THE FIVE MAJOR OBJECTIVES ARE CLASSIFIED ACCORDING TO THE "TAXONOMY OF EDUCATIONAL OBJECTIVES." THE DOCUMENT ALSO CONTAINS (1) LISTS OF THE MEMBERS OF THE CONSULTING AND REVIEWING COMMITTEES, (2) AN EXTENSIVE BIBLIOGRAPHY, AND (3) A CONDENSED VERSION OF THE "TAXONOMY OF EDUCATIONAL OBJECTIVES"--BOTH COGNITIVE AND AFFECTIVE DOMAINS. THIS DOCUMENT IS ALSO AVAILABLE FROM SCIENCE RESEARCH ASSOCIATES, INC., 259 EAST ERIE STREET, CHICAGO, ILLINOIS 60611. (DS)

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Objectives of Science Education

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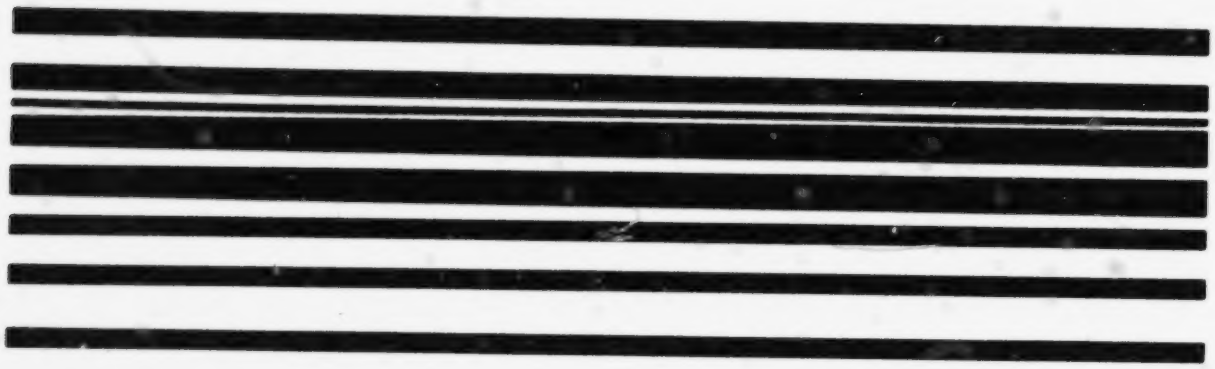

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OBJECTIVES OF SCIENCE EDUCATION

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INTRODUCTION

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Background

In July 1965, Science Research Associates undertook a project for the Carnegie Corporation to delineate the objectives of science education in the United States. These objectives were to be used in connection with the work of the Exploratory Committee on Assessing the Progress of Education, which is investigating the feasibility of a national assessment of educational progress. The objectives were to reflect what schools currently consider important goals of science education. Eventually they might serve as a guide to the development of a comprehensive program to assess the educational attainments of representative nine-year-olds, thirteen-year-olds, seventeen-year-olds, and adult high school graduates.

Method

The objectives listed in this report were derived from

(1) a study of the literature,

(2) statements of members of the Committee of Consultants, and

(3) comments by reviewers of the preliminary draft of objectives.

The method used was to study the published literature and solicit opinions, write material, have it reviewed by qualified people, rewrite it, and have it further reviewed. The Committee of Consultants provided

overall guidance and reviewed two preliminary versions of the objectives, interjecting their own ideas at each stage. In addition, more than 150 other people actively concerned with improving science education were given the opportunity to review the preliminary draft of objectives. These included scientists; professors of science education; officers of national, state, and local science teachers associations; science curriculum specialists; directors of NSF-sponsored curriculum projects; state, county, and city school superintendents; and experienced science teachers at all grade levels. The vast majority of these people are among those sincerely concerned with the purposes and problems of science education.

For the benefit of those participating in the project, an educational objective was defined as a statement about the behavior expected of a learner after he has participated in certain experiences. Wherever possible, objectives were stated in behavioral terms such as define, explain, diagram, and so on, since the actual tasks useful in measuring their attainment then follow simply and logically. However, no objectives were omitted merely because they could not be phrased in behavioristic terms. To do so would be to confer unwarranted validity on those that could be so phrased, and to consign those that could not to unwarranted obscurity.

The Report

The report summarizes the results of our efforts to list the desired goals of science education. The statement of each of the five major objectives is followed by minor objectives--examples of the behavior or attitudes characteristic of a person who has attained the major objective. Taken as a whole, all the minor objectives would characterize the idealized product of science education. Thus, while the major objectives are applicable at each age level, no one is expected to have attained all the minor objectives.

The minor objectives are classified according to the Taxonomy of Educational Objectives, Handbook I: Cognitive Domain and Handbook II: Affective Domain. A summary of the categories is provided in the Appendix of the report.

The number after each minor objective represents the lowest age level (9, 13, 17, 30) at which the majority of the reviewers felt the objective should be assessed. All the objectives were believed to be continuous and cumulative; that is, any objective appropriate for nine-year-olds is also appropriate for the other age levels.

The five major objectives were not given equal emphasis by most of the reviewers or the Committee of Consultants. In consensus, the emphasis given was approximately as follows:

	Age level			
Objective	9	13	17	Adult
1. Methods of science	25	20	20	10
2. Content	30	35	40	40
3. Science in society	10	15	15	25
4. Interests	25	20	15	15
5. Science as intellectual activity	10	10	10	10

The main portion of the report is followed by a listing of the Committee of Consultants, Reviewers of the preliminary outline of objectives, and references we have found useful. To give credit where due, it should be noted that most of the ideas in the report came from these sources. The report represents a consensus of many diverse approaches and opinions, and--as is true of any consensus--while many people will find most of the ideas acceptable, no one will find it perfect.

THE OBJECTIVES OF SCIENCE EDUCATION

The Major Objectives of Science Education

A comprehensive program in science education must consider two numerically unequal groups of students: those who may eventually pursue scientific or technical careers, and the great majority: those who will not. As our population increases and our economy expands, the national need for scientific and technical personnel will continue to increase. Thus, science education must give a realistic introduction to scientific and science-related work for those students capable of it, while at the same time encouraging, developing, and testing their interests and enthusiasm in careers in science and technology.

Even more attention, however, must be given to the great majority of students who will not eventually pursue scientific or technical careers. In a free society it is the citizens from all walks of life who make the public decisions, and in an increasingly technological age more of these decisions can be intelligently made only with an understanding of the scientific considerations that bear upon them. Also, the success of the entire scientific enterprise depends to a great extent on the atmosphere of its surrounding culture. If the general attitude is to be favorable to the scientific enterprise, the public must have some degree of awareness of the place of the scientific endeavor in man's intellectual heritage, the importance of basic research in science, and the potential contributions of the applications of science to a better, or worse, way of life. Thus the schools attempt to produce a scientifically literate citizenry generally favorably

disposed toward supporting the work of scientists.

To achieve these goals, science education programs attempt to bring about measurable improvement in the following characteristics of students:

1. Their ability to apply, in appropriate situations, the methods, techniques, and rational processes associated with scientific work.

2. Their understanding of the major conceptual schemes that currently interrelate, and form the core of, the various scientific disciplines.

3. Their understanding of the position, limitations, and potential of science and its applications in today's society, and their attitudes toward scientists and their work.

4. Their interests in science, which for some students are manifested by movement toward scientific or technical careers, and for all students are displayed outside formal schooling by their continued learning in, and attention to, scientific subjects.

5. Their realization of science as a human intellectual activity.

Objective 1

A person who has attained the major objectives of science education should be able to apply, in appropriate situations, the methods, techniques, and rational processes associated with scientific work.

In recent years emphasis in science teaching has shifted from "science is an organized body of knowledge" to "science is a process of inquiry." The underlying belief is that the ability to inquire is the best preparation for a world of change, and releases an individual from the limitations of present knowledge. To help attain this objective, considerable attention is given at all educational levels to making the student an active participant in open-ended problem-solving situations. The situations can be either those constructed specifically for classroom and laboratory work or those that might be found naturally in the environment. Age level, subject content, required equipment, degree of originality, and the extent of structure built into the problem vary over a wide range; in each case, however, students are given an opportunity to "do" science at a level commensurate with their physical and mental maturity.

While the general public and even certain textbooks may still refer to "the scientific method," most scientists and science educators take exception to the use of the definite article the. Even if it is conceded that there is a general pattern which can be applied in retrospect to many scientific investigations, the idea that there is a specific series of steps that are sequentially followed in all science investigation is no longer considered tenable.

An outline of abilities that might be assessed under this objective is given below.

Comprehension

Interpret information presented in graphs, tables, charts, diagrams, and formulas 9*

List in detail the observable characteristics of a given phenomenon 9

Organize data into a more meaningful or simpler form 13

Draw reasonable extrapolations or recognize trends in a set of data 9

List the type of data most useful in attempting to solve a given problem 13

Recognize the appropriateness and limitations of measuring devices in a given situation 13

Identify necessary safeguards in an experimental or practical situation 13

Suggest the control for a given experiment 13

Translate data into graphs, tables, or charts 13

Application

Use experimental procedures suitable to the solution of a problem 13

Such procedures might be:

1. Devise experiments appropriate to the solution of a problem
    a. Select the main factor in the experiment
    b. Allow for only one variable where possible and appropriate
    c. Establish controls for the experimental factor
2. Perform the experiment
    a. Identify facts and make hypotheses about causes

*The number indicates the lowest of the four age levels (9, 13, 17, 30) at which the objective should be assessed.

b. Perform the experiment under varying conditions

c. Repeat the experiment a sufficient number of times to improve reliability

d. Determine and record qualitative and quantitative data

e. Develop a logical organization of recorded data

f. Generalize on the basis of the data if this is warranted

g. Recognize the place of theory in interpreting data

h. Modify the approach on the basis of the results

3. Manipulate the laboratory or home equipment needed to solve the problem

a. Design, construct, or select apparatus to do a specific task

b. Avoid hazards and consequent personal accidents

Recognize and use pertinent arguments, reasons, or principles to justify a prediction or course of action 13

Analysis

Draw generalizations from a body of data 13

Identify the factor most likely to have caused a given change in a system 9

Identify uncontrolled factors in an experimental situation 13

Isolate and concisely state the major idea of a problem 13

Synthesis

Make a tentative generalization after examining several independent observations 13

Suggest mathematical formulas or verbal generalizations to summarize the relationships shown in a given set of data 17

Devise an experiment to test a hypothesis about an unfamiliar situation 17

Evaluation

Recognize when necessary and sufficient data are available to support a conclusion 13

Judge the precision of a suggested answer in light of the precision of the data 17

Judge whether a quantitative answer lies outside the limits of experimental error 17

Evaluate the relevancy of a hypothesis to a given set of data 17

Identify procedural or logical errors in a given situation 17

An outline of attitudes that might be assessed under this objective is given below.

The level of being aware of and giving attention to phenomena

Recognizes the tentative nature of scientific theories and conclusions 9

Is a careful observer of environmental phenomena being studied 9

Is willing to listen to or read evidence supporting ideas contrary to his personal opinions 9

The level of complying with, being willing to respond to, or deriving satisfaction from phenomena

Is reluctant to base a conclusion on one or a few observations 9

The level of accepting, preferring, or showing commitment to a value

Assumes that there is a universal basis for cause and effect 9

Assumes that man is capable of eventually understanding most of his environment 9

Maintains an alert skepticism toward statements of authority in scientific discourse 13

Seeks evidence from a variety of dependable sources 13

Demands more than vague explanations of questions 9

The level that shows a generalized set or a characterization of a value complex

Is willing to consider new evidence and change an opinion or conclusion because of this evidence 9

Is intellectually honest and does not lose objectivity when there is an element of personal pride, bias, prejudice, or ambition 9

Will plan procedures to solve simple problems and defend his ideas 9

Objective 2

A person who has attained the objectives of science education should understand the major principles, concepts, and theories that currently interrelate, and form the core of, the various scientific disciplines.

While there is still some disagreement concerning which concepts should be taught, it is apparent that students spend much of their time in science class studying the facts, laws, and theories of given areas of science. Examining the methods of science and developing interest in science are not things to be accomplished *in vacuo*, but rather in conjunction with examples of investigations in a given content area.

The content emphasis of science courses is now placed on a fairly small number of broad conceptual schemes, such as:

1. The basic scheme of human physiology and its relation to health, nutrition, and reproduction 9
2. The present model of the universe and celestial mechanics 9
3. The particle nature of matter and the interaction of units 13
4. The kinetic-molecular theory 13
5. The conservation laws 9
6. Electromagnetic radiation and wave phenomena 17
7. The evolutionary character of geological changes and biological development 13
8. Equilibrium systems and the concepts of minimal energy content and random energy distribution 13
9. The relationship between an organism and its environment 9

It is hoped that by using such conceptual schemes, and the experimental evidence on which they are based, a student will not only gain

information useful in interpreting phenomena in his environment, but will also have a better opportunity to understand science as a process of inquiry into natural phenomena.

An outline of abilities that might be assessed under this objective is given below.

Comprehension

Explain certain important phenomena at an appropriate level of sophistication 9

Give specific illustrations or examples of generalizations 9

Explain how new material is related to previous knowledge 9

Identify reliable sources of information concerning a given problem 13

Application

Perform numerical operations when necessary for the solution of a problem 13

Apply relevant principles to familiar or unfamiliar situations 13

Predict the effect of a specific change in a closed system 13

Describe an event or experiment using appropriate terms and language 9

Analysis

Identify unstated assumptions involved in a conclusion or course of action 17

Identify possible cause-and-effect relationships when interpreting a given phenomenon 9

Identify the principles that apply to a given situation 13

Synthesis

Devise an experiment to test a hypothesis about a familiar situation 9

Select a learned theory or principle that is consistent with given facts, observations, or data 13

Evaluation

Judge the appropriateness of a given prediction, conclusion, or course of action 13

Judge the relevancy of data to the immediate problem 9

Objective 3

A person who has attained the major objectives of science education should recognize the position, limitations, and potential of science and its applications in today's society, and should display generally favorable attitudes toward scientists and their work.

Remembering that science education for most of the population ends during high school, and that daily reliance on science and its applications is constantly increasing, most educators place special emphasis on acquainting students with the role of science and technology in contemporary life.

An outline of attitudes that might be assessed under this objective is given below.

The level of being aware of and giving attention to phenomena

Can give examples of some of the applications of science to life comfort and discomfort 9

Can explain why it is necessary to conserve and develop natural resources 9

Can give examples of ways to conserve and develop natural resources 9

Can give examples of possible applications of scientific knowledge to the solution of important social problems, such as overpopulation and fuel, food, and water supplies 13

Can give examples of ways in which applications of science have increased through medical advances 13

Can give examples of changes brought about by technology and some of the problems that have resulted 13

Can suggest ways in which scientific knowledge might help to raise universal standards of living 13

Can describe the essential differences between pure and applied science 17

Can cite instances in which scientific discoveries have raised new questions or problems 13

Can cite instances in which scientific theories are not in precise conformity with natural phenomena 17

Can explain the reasons underlying the often diverse positions of scientists toward problems such as nuclear weapons, population control, and fluoridation 17

Can cite instances in which there was a time lag between the establishment of scientific knowledge and its general acceptance by social groups 17

The level of accepting, preferring, or showing commitment to a value

Uses the advances of science and technology that contribute to public health and safety 17

Can give examples to show the causal role of science and technology in creating social and economic problems and in aiding in their intelligent solution 13

Shows evidence of working to obtain a science background more adequate for understanding the modern world 13

Applies science principles and knowledge in appropriate consumer activities 17

Can give examples of disruptive uses of scientific developments as well as beneficial ones 17

Is willing to support bills giving public expenditures to warranted scientific research Adult

Objective 4

A person who has attained the major objectives of science education should show an interest in science by continuing to learn about science on his own, by giving attention to science-related issues even after completing his formal education, and, if he is capable and interested, by pursuing a scientific or technical career.

Some of the subheadings under this objective are more relevant for those people actually planning a scientific career, but most are applicable to the general public. One should approach them with the question in mind: "Would performance of this activity or possession' of this attitude indicate an interest in science?"

An outline of attitudes that might be assessed under this objective is given below.

The level of being aware of and giving attention to phenomena

Knows of some of the projects being supported with public funds 17

Knows some contemporary scientific ideas 17

Reads the scientific sections of newspapers and magazines 13

Can give examples of the vocational and leisure implications of technology 13

Knows of career opportunities in scientific and technical fields 17

Knows various sources of information concerning scientific careers 17

Knows of some eminent scientists and their discoveries 9

The level of complying with, being willing to respond to, or deriving satisfaction from phenomena

Desires further knowledge of science 9

Is skeptical of claims of radio, magazine, and other forms of

popular scientific or pseudoscientific advertising and wants valid evidence 13

The level that shows conceptualization or organization of a value system

Chooses, if he finds he has the talents, to prepare for a scientific or technical career 17

Undertakes scientific reading, experimentation, or other activities on his own initiative for his own pleasure 13

Has opinions concerning the social and moral responsibility of scientists 17

Exhibits a desire to know and to discover 9

Is curious about nature and the universe 9

Uses the forces and materials in his environment in a manner he considers intelligent 13

Undertakes an educational program leading to an advanced degree involving original research in a scientific discipline 17

Objective 5

A person who has attained the major objectives of science education should recognize the nature of science as a human intellectual activity, distinguished from the many applications of scientific knowledge.

"Science" is so widely equated to, or confused with, the many applications of scientific knowledge that many people have an almost totally utilitarian view of this human enterprise. While many scientists do work on applications, the pure scientist is curious only to learn, to look more deeply or remotely, to help add a little to our understanding of the universe. Much of his new understanding may never find a practical application, but this in no way diminishes his satisfaction. Science education attempts to impart this view of science to those who will not become scientists as well as to those few who may.

An outline of attitudes that might be assessed under this objective is given below.

The level of being aware of and giving attention to phenomena

Understands that science is basically an intellectual activity 13

Understands that when there is a conflict between a scientific theory and well-confirmed observable facts, the great majority of scientists will reject the theory and hope (or strive for) a new theory, or a modification, in better agreement with the facts 13

Understands that no standard method or procedure for successful scientific discovery can be identified 13

Understands that science, as a human enterprise, has self-checking methods of refining and extending its understanding of the universe, but claims no method for identifying absolute truth 13

Understands that the criteria for success in scientific achievement are basically different from those in art, religion, literature, history, or other intellectual activity 17

Understands that the methods of scientific inquiry cannot now and may never be able to settle questions in nonscientific fields such as religion, art, and so on 13

Knows certain important historical and philosophical developments in science 13

Appreciates that while the intellectual activity of scientists involves much disciplined rational thought, the creative side is largely irrational and unexplained 13

Appreciates that scientific activity is similar to both art and philosophy in its search for order and structure 17

Recognizes that the history of science is the record of the growth of ideas about the natural environment 17

Believes that scientists represent a typically diverse group of educated people, rather than supermen or absentminded professors 13

Appreciates that creativity in science is just as thrilling an experience for a scientist as is the corresponding experience for an artist or a musician 13

Recognizes that science prospers in a supportive social and economic environment 17

<u>The level of complying with, being willing to respond to, or deriving satisfaction from phenomena</u>

Experiences genuine curiosity in unexplained phenomena 9

Appreciates the emotional as well as the intellectual satisfactions which come to a scientist who achieves a significant synthesis of

previously discordant data, or a new unifying theory 13

Appreciates the similarity of emotional response by sensitive people to different stimuli (the formal beauty of the Greek Parthenon and the formal beauty of the structure of organic molecules, for example) 17

The level of accepting, preferring, or showing commitment to a value

Shows a willingness to recognize the irrationality of belief in superstitions, despite a recognizable basis on common sense in many cases 13

Shows a willingness to suspend judgment when alleged "eyewitness" reports are offered in support of phenomena clearly contradictory to widely accepted scientific principles 13

Believes that science is worthy of study in and of itself 17

Has opinions about the type of social and political environment necessary for the survival and integrity of science 17

THE COMMITTEE OF CONSULTANTS

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We are extremely grateful to the Committee of Consultants for the time taken from their busy schedules to provide guidance to this project. Their ideas and suggestions, as well as their critical reviews, were invaluable in preparing the final report. In fairness to the members of the committee, we must emphasize that many differences of opinion still have not been resolved, and it should not be inferred that members are in complete agreement on the content of the final report.

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The preliminary outline of "The Objectives of Science Education" was sent to the following people for review and criticism. A reply was received from those marked with an asterisk. We wish to thank these people for their comments and suggestions, many of which were incorporated into succeeding versions of the report. It should be emphasized that there was a wide range of opinions and differences of emphasis, and it should not be assumed that all reviewers agreed with the content of the preliminary draft.

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APPENDIX

A Condensed Version of the Taxonomy of Educational Objectives

The Cognitive Domain

Knowledge

For purposes of measurement, knowledge objectives involve little more than remembering or recognizing the appropriate material. Although some alteration of the task may be required, this is a relatively minor part of the task. Some typical knowledge questions are suggested by the following:

1. Give functional and abstract definitions of each of the following items.
2. Where could you find additional information on this topic?

Comprehension

The comprehension objectives emphasize the type of understanding that an individual needs in order to know what is being communicated and to make use of it without necessarily relating it to other material or seeing its fullest implications. Possible comprehension questions are suggested by the following:

1. What is the meaning of a particular statement or formula?
2. Which of the following familiar observations is an example of a particular given theory?

Application

The application objectives emphasize the use of abstractions (such as general ideas or methods, technical principles, theories) in specific situations. Possible application questions are suggested by the following:

1. What other examples from the student's experience are related to the material which has been presented?

2. What is the relation of the material to scientific information the student already has?

Analysis

The analysis objectives emphasize the breakdown of the material into its constituent parts and the retention of the relation between the parts and of the way they are organized. Questions in this area may also be directed at the techniques and devices used to convey the meaning or to establish the conclusions of a communication. Possible analysis questions are suggested by the following:

1. What scientific laws, concepts, or principles are implicit in this situation?
2. What factor is most likely to have produced this change in the system?

Synthesis

The synthesis objectives emphasize the putting together of elements and parts to constitute a pattern or structure not clearly there before. Possible test questions are suggested by the following:

1. What would be a suitable way of testing the hypothesis presented?
2. What hypothesis could be made that would adequately account for many of the data of the phenomena?

Evaluation

The evaluation objectives emphasize the process of making judgments about the value of material and methods for given purposes: that is, quantitative and qualitative judgments about the extent to which material and methods satisfy criteria. These criteria may be either those that

are widely accepted in the field or criteria which the student is required to develop. Possible evaluation questions are suggested by the following:

1. What are the logical inconsistencies in the material presented?
2. Did the experimenter use the best possible method in attempting to solve a given problem?

The Affective Domain

Receiving and Attending to Stimuli

At this level we are concerned that the learner be sensitized to the existence of certain phenomena and stimuli; that is, that he be willing to receive or to attend to them. This is clearly the first and crucial step if the learner is to be properly oriented to learn what the teacher intends that he will. To indicate that this is the bottom rung of the ladder, however, is not at all to imply that the teacher is starting de novo. Because of previous experience (formal or informal), the student brings to each situation a point of view or set which may facilitate or hinder his recognition of the phenomena to which the teacher is trying to sensitize him.

Responding to Stimuli

At this level the student is sufficiently motivated so that he is not just willing to attend to phenomena, but actively to attend. As a first stage in a "learning by inquiry" process the student is committing himself in some small measure to the phenomena involved. This is a very low level of commitment, and we would not say at this level that this was "a value of his" or that he had "such and such an attitude."

Valuing

This is the only category headed by a term which is in common use in the expression of objectives by teachers. Further, it is employed in its usual sense: that a thing, phenomenon, or behavior has worth. This abstract concept of worth is in part a result of the individual's own valuing or assessment, but it is much more a social product that has

been slowly internalized or accepted and has come to be used by the student as his own criterion of worth.

Behavior categorized at this level is sufficiently consistent and stable to have taken on the characteristics of a belief or an attitude. The learner displays this behavior with sufficient consistency in appropriate situations so that he comes to be perceived as holding a value. At this level we are not concerned with the relationships between values but rather with the internalization of a set of specified, ideal values. Viewed from another standpoint, the objectives classified here are the prime stuff from which the conscience of the individual is developed into active control of behavior.

Organization of a Value System

As the learner successively internalizes values, he encounters situations for which more than one value is relevant. Thus necessity arises for the organization of the values into a system, the determination of the interrelationships among them, and the establishment of the dominant and pervasive ones. Such a system is built gradually, subject to change as new values are incorporated. This category is intended as the proper classification for objectives which describe the beginnings of the building of a value system.

Characterization by a Value Complex

At this level of internalization the values already have a place in the individual's value hierarchy, are organized into some kind of internally consistent system, and have controlled the behavior of the individual long enough for him to have adapted to behaving this way.